EXHIBIT 53

Spokane River Regional Toxics Task Force Phase 2 Technical Activities Report: Identification of Potential Unmonitored Dry Weather Sources of PCBs to the Spokane River

Prepared for:
Spokane River Regional Toxics Task Force

August 12, 2015

LimnoTech

Water Environment | Scientists Engineers

EXHIBIT
DILKS 3.
1.23.20
PENGAD 800-631-6989

Blank Page

LimnoTech
Water Environment | Scientists Engineers

501 Avis Drive
Ann Arbor, MI 48108
734.332.1200
www.limno.com

Spokane River Regional Toxics Task Force
Phase 2 Technical Activities Report:
Identification of Potential Unmonitored Dry Weather Sources of PCBs to the Spokane River

Prepared for:
Spokane River Regional Toxics Task Force
August 12, 2015

Blank page

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Blank Page

EXECUTIVE SUMMARY

The Spokane River and Lake Spokane have been placed on the State of Washington's 303(d) list of impaired waters because of concentrations of polychlorinated biphenyls (PCBs) that exceed water quality standards[1]. To address these impairments, the Department of Ecology (Ecology) is pursuing a toxics reduction strategy that included the establishment of a Spokane River Regional Toxics Task Force (SRRTTF) to identify and reduce PCBs at their source in the watershed.

The Work Plan developed by the Task Force (SRRTTF, 2012) identified four distinct phases of work:

- Phase 1: Review of existing data and reports, development of a data gaps assessment with recommendations for additional sampling, preparation of a Quality Assurance Project Plan for collection of additional data, and recommendation of analytical modeling tools to be used in Phase 3.
- Phase 2: Collection of additional data
- Phase 3: Analysis of data to characterize and quantify PCB sources
- Phase 4: Assessment of potential Best Management Practices and development of a Comprehensive Plan

This report documents Phase 2 technical activities, which focused on carrying out a synoptic survey to identify potential unmonitored dry weather sources of PCBs to the Spokane River. The survey was successfully conducted between August 12 and 24, 2014. Activities were conducted in accordance with the Quality Assurance Project Plan (LimnoTech, 2014c) and Sampling and Analysis Plan (LimnoTech, 2014d) developed for this project.

The following conclusions and "lessons learned" can be gathered from the data collected:

- The low concentrations of PCBs in the Spokane River (i.e. at magnitudes sometimes similar to those observed in blank samples) make precise calculations impossible and instead can best support semi-quantitative analyses.
- While the intent of this study was to collect sufficient data to conduct a semi-quantitative mass balance assessment on six individual segments of the Spokane River, this intent was not fully realized due to:
  - The absence of stream flow gaging data at the Lake Coeur d'Alene outlet and at Greene St.
  - Dam operations at Nine Mile Dam causing large fluctuations in river flow that violated the assumption of steady state conditions.

[1] PCB concentrations utilized to place the Spokane River and Lake Spokane on the 303(d) list were derived from fish tissue concentrations and a bioconcentration factor specified in the National Toxics Rule.

- There is very likely a large (i.e. as large as any other single dry weather source) incremental PCB load entering the Spokane River between Barker Road and the Trent Avenue Bridge. There is the possibility of a large incremental PCB load entering the Spokane River between Greene Street and the Spokane gage. While Phase 2 activities are ongoing, Phase 3 activities are now underway to characterize the specific nature of these sources.

1 INTRODUCTION

The Spokane River and Lake Spokane have been placed on [Category 5 of] the State of Washington's 303(d) list of impaired waters because of concentrations of polychlorinated biphenyls (PCBs) that exceed water quality standards. The Spokane River and Lake Spokane (also known as Long Lake, herein referred to as Lake Spokane) exceed the water quality standard (170 pg/l – based on a fish consumption rate of 6.5 g/day) for PCBs. Fifteen waterbody segments of the Spokane River and Lake Spokane and one segment of the Little Spokane River are on the 2008 303(d) list for exceeding human health water quality criteria for PCBs. The Spokane Tribe of Indians have water quality standards for PCBs in the Spokane River below Lake Spokane (also known as the Spokane Arm of Lake Roosevelt) that are more than 95% lower than State standards (1.3 pg/l), based on a higher fish consumption rate (865 g/day) than the general population (Spokane Tribe of Indians, 2010). PCBs are not listed in Idaho. While PCB concentrations utilized to place the Spokane River and Lake Spokane on the 303(d) list were derived from fish tissue concentrations and a bioconcentration factor, historical monitoring of water column PCB concentrations has also been conducted (Serdar et al, 2011; Era-Miller, 2014).

To address these impairments, the Department of Ecology (Ecology) is pursuing a toxics reduction strategy that included the establishment of a Spokane River Regional Toxics Task Force (SRRTTF) to identify and reduce PCBs at their source in the watershed. The stated objective of the Task Force (SRRTTF, 2012) is "to work collaboratively to characterize the sources of toxics in the Spokane River and identify and implement appropriate actions needed to make measurable progress towards meeting applicable water quality standards." In order to take this approach, the SRRTTF has determined that it needs to develop a sufficient clearer understanding of in-stream loadings and source contribution to the Spokane River between its headwaters at the outlet of Lake Coeur d'Alene and the Nine Mile Dam. This 53 mile segment of the river has been chosen to be the focus of the SRRTTF's initial efforts for several reasons. In no particular order they are:

- Discharges from all of the major municipal and industrial sources in the watershed are located in this section
- Virtually all urban area storm runoff in the watershed enters the river in this section
- This section of the river contains numerous river flow gaging stations, which will allow for the determination of in-stream loadings at multiple locations through semi-quantitative mass balance calculations
- In this section of the river the vast majority of the aquifer/river interchange occurs, the impact of which has not been quantified by previous studies

- The likelihood of making near term source contribution reductions is greatest in this section of the river given the concentration of point source and storm runoff locations and the significant level of unidentified source contribution
- The ability to monitor and assess the effectiveness of PCB reductions is enhanced by the ability to track in-stream loadings with the infrastructure present (gauging stations) in this section of the river

The Work Plan developed by the Task Force (SRRTTF, 2012) identified four distinct phases of work:

- Phase 1: Review of existing data and reports, development of a data gap assessment with recommendations for sampling, preparation of a Quality Assurance Project Plan for collection of additional data, and recommendation of analytical modeling tools to be used in Phase 3.
- Phase 2: Collection of additional data
- Phase 3: Analysis of data to characterize and quantify PCB sources
- Phase 4: Assessment of potential Best Management Practices and development of a Comprehensive Plan

The majority of Phase 1 activities were completed in 2013, and are documented separately in LimnoTech (2013a, 2013b, 2013c, and 2013d). Findings from these Phase 1 activities were presented at a Technical Monitoring Workshop in Spokane on December 4-5, 2013. The key conclusions from this workshop were as follows (LimnoTech, 2014a):

- It is not feasible to gain a detailed understanding of all contributing PCBs sources in a one (or two) year monitoring program.
- The first year of monitoring should focus on gaining a better understanding of existing dry weather sources, through baseline monitoring of the Spokane River above Lake Spokane. Groundwater/surface water interactions are extremely important in the Spokane River, with the much of the flow exiting Lake Coeur d'Alene during low flow periods being lost to groundwater, and river flows in the Spokane area comprised primarily of groundwater inflow.

Based on the workshop consensus, the objective of first-year Phase 2 monitoring was to collect the necessary data to eliminate the dry weather data gaps. Specifically, the collected data should be sufficient to support a semi-quantitative mass balance assessment, and be able to identify stream reaches where incremental loads lead to a significant increase in river concentrations. The data should also be sufficient to support an adaptive management approach, where grab sample results can be directly compared to results from other sampling methodologies to allow determination of an improved monitoring approach for future phases of this work. The resulting monitoring program consisted of two components:

- A synoptic survey, conducted during summer low flow period
- Seasonally integrated sampling

The intent of the low flow synoptic survey was to support the semi-quantitative mass balance assessment, and be able to identify stream reaches where incremental loads lead to a significant

increase in river concentrations. The intent of the seasonally integrated sampling was to provide insight on the seasonal variability of loading from Lake Coeur d'Alene, composited over a wide flow regime.

This report documents the results of the above monitoring program and subsequent analyses. It is divided into sections of:

- Synoptic Survey
- Mass Balance Assessment
- Seasonally Integrated Sampling

Blank Page

2
SYNOPTIC SURVEY

A dry weather synoptic survey was conducted between August 12 and 24, 2014. Activities were conducted in accordance with the Quality Assurance Project Plan (LimnoTech, 2014c) and Sampling and Analysis Plan (LimnoTech, 2014d) developed for this project. Field activities are documented in Gravity (2015). Each of the above documents is included as an appendix to this report.

2.1 Monitoring Locations

Sampling locations (Figure 1) included seven Spokane River stations, one station near the mouth of Hangman Creek, and seven point source discharges. The Spokane River stations were located at:

- Spokane River at Lake Coeur d'Alene Outlet
- Spokane River at Post Falls
- Spokane River at Barker Rd. Bridge
- Spokane River below Trent Ave. bridge
- Spokane River at Greene St.
- Spokane River at Spokane USGS Gage
- Spokane River below Nine Mile Dam

The point source discharges consisted of:

- Coeur d'Alene Advanced WWTP
- Post Falls WWTP
- Liberty Lake Sewer & Water District
- Kaiser Aluminum
- Inland Empire Paper
- Spokane County Regional Water Reclamation Facility
- City of Spokane Riverside Park Advanced WWTP

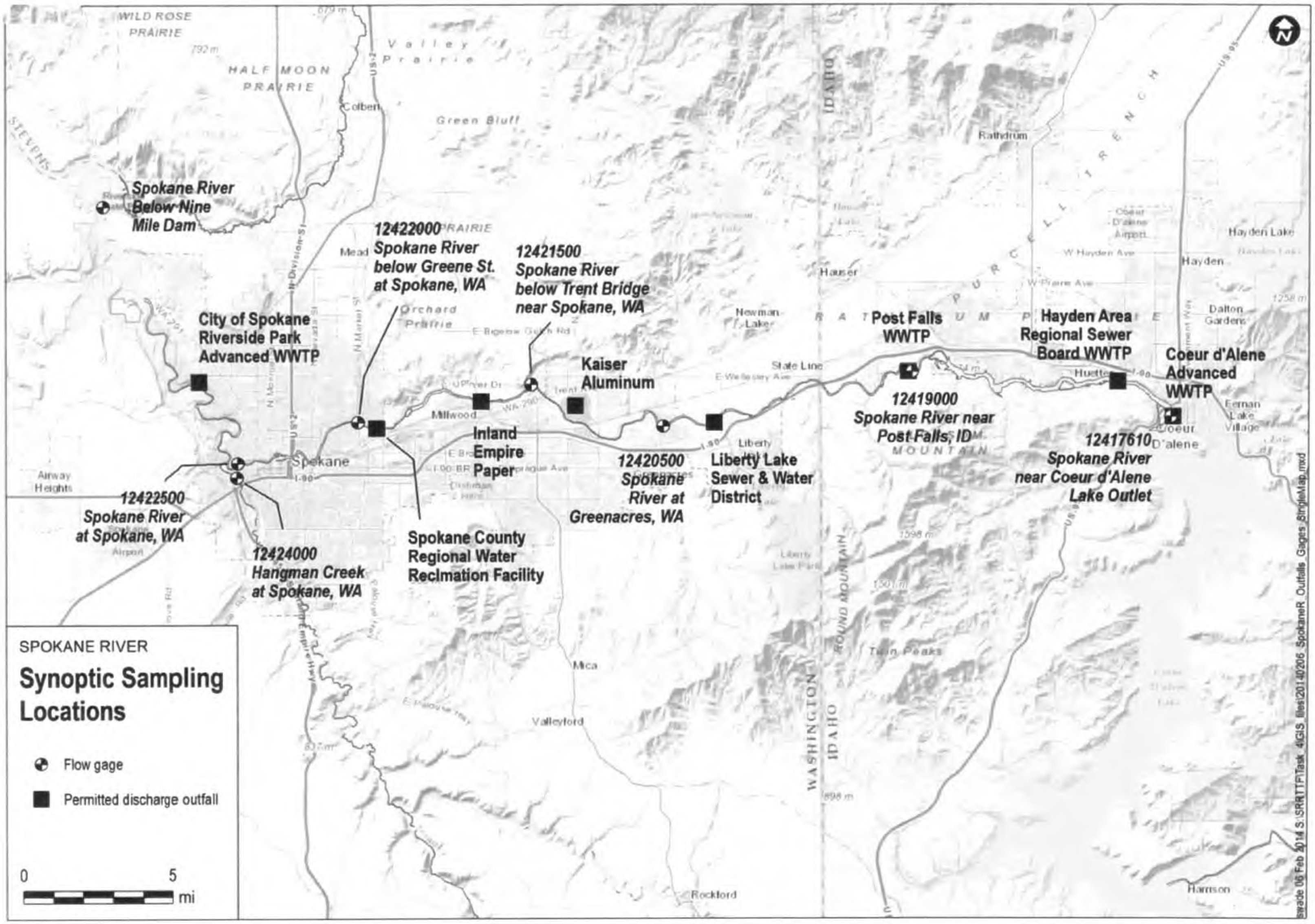

Figure 1. Sampling Locations for August 12-24, 2014 Synoptic Survey

2.2 Field Sampling Activities

The field sampling activities as planned and implemented are detailed in the project QAPP (LimnoTech, 2014c), SAP (LimnoTech, 2014d) and Gravity (2015) field report, all of which are included as appendices to this report. This section summarizes those activities. Environmental specialists from Gravity Consulting led the sampling event and collected samples along with representatives from LimnoTech and Washington State Department of Ecology. Grab samples were collected by hand using "clean hands" and "dirty hands" methodology combined with direct immersion techniques at most of the prescribed locations. These methods reduce the likelihood of any cross-contamination from direct (e.g., handling dirty equipment) or indirect (e.g., dust or air transport) sources. Samples were collected using a dip sampler at a few of the facilities due to safety concerns with access.

Surface water grab samples were collected on August 12, 14, 16, 18, 20, 22, and 24 at the Stations listed in Section 2.1. One additional river sample was collected on August 23rd in accordance with the SAP due to a rain event in Idaho the evening of August 22. In addition to the above grab sample monitoring, sampling was conducted at the Lake Coeur d'Alene outlet and below Nine Mile Dam on August 15 and 24 using Gravity's high volume water sampling system. The intent of the high volume sampling was to support an adaptive management approach, where grab sample results could be directly compared to results from other sampling methodologies to allow determination of an improved monitoring approach for future phases of this work.

Point source effluent was sampled on August 13, 19, and 24. Effluent from the Hayden Area Regional Sewer Board WWTP was not sampled, as there was no discharge to the river from this facility during the survey period.

2.3 Analytical Results

Field samples were shipped to AXYS Analytical Laboratories, Ltd. in Sidney, British Columbia, for analysis of PCB concentrations. PCB concentrations for individual congeners were blank-corrected following the process defined in the QAPP (LimnoTech, 2014c). A separate set of samples were taken to SVL Analytical, Inc. in Coeur d'Alene, ID for analysis of total dissolved solids, total suspended solids, total organic carbon, dissolved organic carbon.

2.3.1 Data Quality Assessment

All data were reviewed for quality assurance in accordance with the project QAPP and as noted in the laboratory EDD-Excel files provided in the appendix. Data quality indicators evaluated for PCBs included the following:

- Daily Calibration Verification
- Lab Control Sample Recovery
- Sample and Method Blank Surrogate Recovery
- Matrix Spike Sample Recovery
- Duplicate sample relative percent differences (RPDs)
- Method blank concentrations
- Completeness

All reviewed QC results complied with QAPP data quality indicators with the exception of a small number of surrogate recovery results and duplicate sample relative percent differences. The out of control surrogate results are below the associated criteria range (25%-125%) for percent recovery specified in the QAPP. Sample results associated with the low surrogate recoveries were qualified as estimated using J/UJ data flags for positive/negative result values. The RPDs for out of control duplicate pairs were above the QAPP-specified criteria (0-50% for congeners >10x EDL). Duplicate pair results associated with the high RPDs were qualified as estimated using the J data flag. There were no changes to PCB result values.

Data quality indicators evaluated for conventional parameters included the following:

- Bias (laboratory control samples, matrix spikes, and blanks)
- Precision (RPD of matrix spikes and replicate samples)
- Completeness

All reviewed QC results for conventional parameters complied with QAPP data quality indicators.

2.3.2 Blank Correction

Total PCB concentrations were corrected for method blank contamination following the procedures defined in the QAPP. Specifically, individual congeners found in the sample at a concentration less than three times the associated blank concentration were flagged, and excluded from calculation of total PCB. It should be noted that there is no standard blank correction method, and numerous approaches are utilized, both nationally and within the Spokane River Basin. The selection of the most appropriate blank correction methodology must consider factors such as: study objectives, sample matrix, sampling methodology, expected range of results, and tolerance for biased results. Figure 2 shows blank-corrected versus non-corrected total PCB concentrations. This figure indicates that blank-correction generally reduced the estimated total PCB concentration by approximately 30 pg/l, compared to the non-corrected samples.

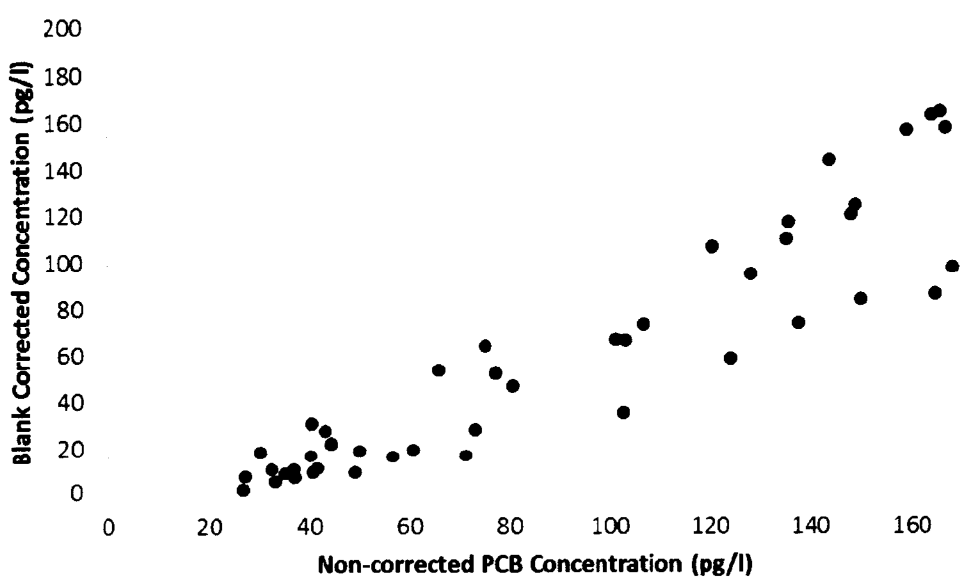

Figure 2. Comparison between QAPP Blank-Corrected and Uncorrected Total PCB Concentrations

The uncertainty in estimated total PCB concentrations due to blank correction was evaluated by comparing the estimated total PCB concentration using the blank correction method in the QAPP to total PCB concentration resulting from an alternate blank correction method. The alternate blank correction selected is patterned after the one used by the Virginia DEQ (2014), and consists of subtracting the maximum of the relevant laboratory or field blank concentration from the sample concentration.

The results of this comparison are shown in Figure 3. For total PCB concentrations less than 200 pg/l, the alternate blank correction methods results in a total PCB estimate that is, on average, 20% less than that resulting from the blank correction method in the QAPP. This provides some qualitative understanding of the uncertainty in total PCB results caused by blank correction. For PCB concentrations greater than 200 pg/l, the method of blank correction is seen to have little effect on the estimated total PCB concentration.

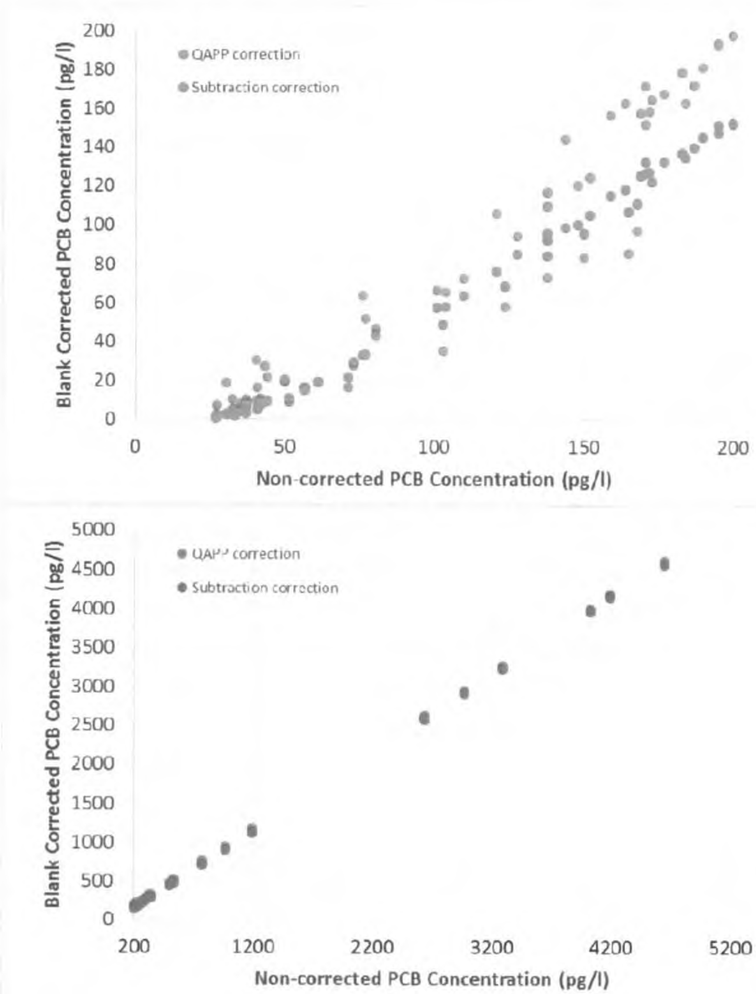

Figure 3. Comparison of the Results of Two Different Blank Correction Methods

No blank corrections were conducted on conventional parameters, as all blank samples for all conventional parameters were below the relevant detection limit.

2.3.3 Total PCB Concentrations in Spokane River

Total PCB concentrations for the river stations are shown in Figure 4. Concentrations are largely below 50 pg/l from the Lake Coeur d'Alene outlet to the Barker Road Bridge. Concentrations are generally between 100 and 200 pg/l from the Trent Avenue Bridge downstream to Nine Mile Dam. Approximately one quarter of all samples exceed the Washington water quality standard of 170 pg/l, while all of the samples exceed the downstream Spokane Tribe of Indians' water quality standard of 1.3 pg/l. These data, along with the tributary and point source data and potential outliers, are discussed in the following section. Furthermore, a detailed listing of PCB concentrations (total PCBs, plus individual homologs) and conventional parameters for each date at each sampling location is provided in Appendix A, and full laboratory data sheets are provided in Appendix F.

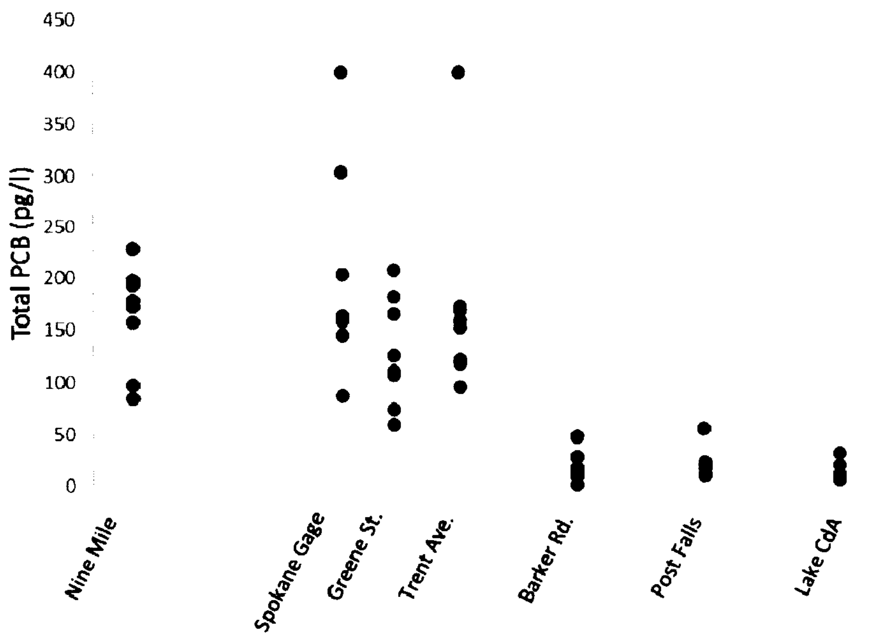

Figure 4. Spokane River Total PCB Concentrations Measured during Synoptic Survey (Outliers in Red)

2.3.4 High Volume Sampling Results

Sampling was conducted at the Lake Coeur d'Alene outlet and below Nine Mile Dam on August 15 and 24 using Gravity's high volume water sampling system. The total PCB concentration measured by the high volume system at the Lake Coeur d'Alene outlet was 83 pg/l on August 15 and 66 pg/l on August 24. These concentrations are higher than those measured by grab samples at the same station, which ranged from 5 to 31 pg/l over the study period, and averaged 13 pg/l. The total PCB concentration measured by the high volume system below Nine Mile Dam was 170 pg/l on August 15 and 130 pg/l on August 24. These concentrations are similar to those measured by grab samples

at that station, which ranged from 84 to 230 pg/l over the study period, and averaged 160 pg/l. Subsequent analysis has indicated that the high volume sampler results may be confounded by contamination that has a silicon tubing signature, as well as elevated concentrations in blanks. This analysis is ongoing as part of an adaptive management approach to allow determination of an improved monitoring approach for future phases of this work.

Blank Page

3
MASS BALANCE ASSESSMENT

The objective of the mass balance assessment is to use the results of the synoptic survey to identify stream reaches where incremental loads lead to a significant increase in river concentrations. This section describes the application of the mass balance assessment, and is divided into subsections of:

- Conceptual approach
- Initial application
- Revisions to initial application

3.1 Conceptual approach

The general conceptual approach of the mass balance assessment is to determine the presence of unmonitored loads by comparing the amount of mass passing through the Spokane River at two locations where flow and concentration measurements are available. The magnitude of the unmonitored load can be determined as the difference in monitored load at the downstream and upstream locations, as depicted below in Figure 3 and Equation 1. Q_u and Q_d represent the river flow at the upstream and downstream stations, respectively, while C_u and C_d represent the upstream and downstream PCB concentrations.

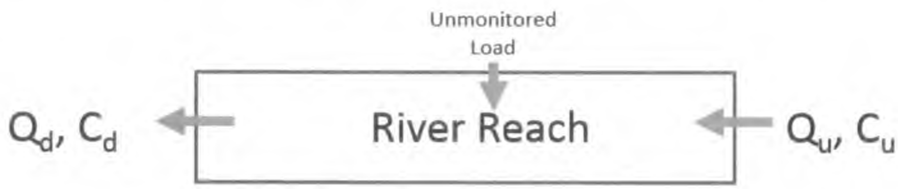

Figure 5. Simplified Description of Mass Balance Approach

The approach is described mathematically in Equation 1.

$$\text{Unmonitored load} = \text{Downstream load} - \text{Upstream load} \quad (1)$$

where:

Downstream load = Flow at downstream location (Q_d) x Concentration at downstream location (C_d)

Upstream load = Flow at Upstream location (Q_u) x Concentration at upstream location (C_u)

Equation 1 is based upon the assumption that environmental loss processes affecting PCBs are relatively insignificant between the two monitoring locations. This assumption was verified using

low-flow hydraulic results from model of the Spokane River, observed data on suspended solids concentrations, and literature values for coefficients related to solids partitioning and volatilization.

The concept can be extended to address situations where a monitored load (e.g. wastewater treatment plant discharge) enters the reach between the upstream and downstream monitoring locations, as shown in Figure 4.

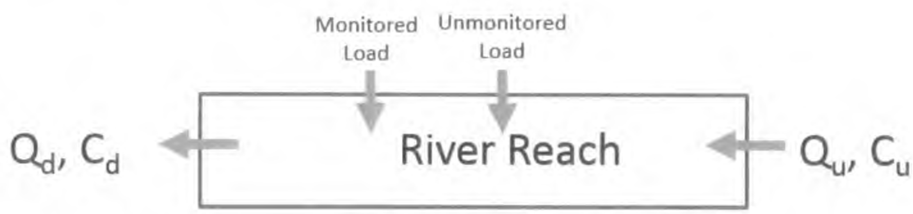

Figure 6. Mass Balance Approach in the Presence of a Monitored Load

In this situation, the mass balance equation is expanded to consider the monitored load as shown in Equation 2.

$$\text{Unmonitored load} = \text{Downstream load} - \text{Upstream load} - \text{Monitored Load} \qquad (2)$$

3.2 Initial application

The mass balance assessment was initially applied prior to the Spokane River Toxics Workshop held in Spokane Valley on January 13th and 14th, 2015. The data on flows and concentrations used in the analysis are provided in Tables 1 through 4.

Table 1. River Flows (cfs) Used in 2014 Mass Balance Assessment

	8/12	8/14	8/16	8/18	8/20	8/22	8/24
Post Falls	640	650	630	810	920	820	730
Barker Rd.	-	270	350	480	570	-	320
Trent Ave.	930	920	920	990	1060	1050	950
Spokane Gage	1030	1050	1080	1140	1250	1140	1140
Hangman Ck.	10	11	15	17	19	18	18
Nine Mile Dam	1040	1060	1100	1160	1270	1160	1160

Table 2. Point Source Flows (cfs) Used in 2014 Mass Balance Assessment

	8/13	8/19	8/24
Coeur d'Alene	5.3	5.4	5.4
HARSB	0	0	0
Post Falls	3.8	3.9	4.0
Liberty Lake	1.1	1.1	1.2
Kaiser Aluminum	13	14	14
Inland Empire Paper	11	11	11
Spokane County	12	12	12
City of Spokane	44	46	43

Table 3. River Total PCB Concentrations (pg/l) Used in 2014 Mass Balance Assessment

	8/12	8/14	8/16	8/18	8/20	8/22	8/24	Composite
Nine Mile	160/ 200*	200	180	170	230	98	84	140
Hangman Ck.	64	66	67/ 73*	53	2400	270	35	95
Spokane Gage	160	160/ 140*	300	200	160	400	86	140
Greene St.	160	210	110	120/ 110*	180	74	59	120
Trent Ave.	170	120	150	400	160/ 170*	95	120	110
Barker Rd.	28	17	9	47	11	1/ 28*	10	29
Post Falls	53	9	22	19	17	19	17/ 9*	230
Coeur d'Alene	19	31	11	9	7	7	5	11

*Replicate sample

Table 4. Discharge Total PCB Concentrations (pg/l) Used in 2014 Mass Balance Assessment

	8/13	8/19	8/21	Composite
City of Spokane	770/ 960*	23000	1200	880
Spokane County	490	330/ 290*	330	270
Inland Empire Paper	3600	3000	2600/ 2600*	2800
Kaiser Aluminum	3300	4000	4600	2500
Liberty Lake	200	190	260	210
Post Falls	220	220	200	180
Coeur d'Alene	1200	530	530	670

*Replicate sample.

Some of the observed PCB concentrations were considered outliers, as they were much higher than other concentrations observed at the same site. These outlier values correspond to river concentrations of 2400 and 270 pg/l measured at Hangman Creek, the 300 and 400 pg/l measured at the Spokane Gage, the 400 pg/l measured at Trent Ave., and 53 pg/l measured at Post Falls. Outlier discharge PCB measurements were observed of 23,000 pg/l at the City of Spokane and 1200 pg/l at Coeur d'Alene. Because the mass balance analysis assumes steady-state conditions, the presence of concentrations un-representative of steady conditions provide the potential of biasing model results. For this reason, the mass balance analysis was conducted twice, once using all data

values and once excluding outliers. The analysis will be considered robust to the extent that the same conclusions are drawn using each of the above approaches for handling outliers.

Results of the analysis are shown in Table 5 and graphed in Figure 7. The primary finding is the presence of a relative large unmonitored PCB source in the river reach between Barker Road and Trent Avenue, with an estimated magnitude of 170 to 240 mg/day depending upon the assumption made regarding outliers. The potential exists for two smaller unknown sources, corresponding to 10 mg/day in the Coeur d'Alene to Post Falls reach and 52 mg/day in the Trent Avenue to Spokane Gage reach. Because the magnitude of these smaller sources strongly depends upon the assumption made regarding outliers, no definitive conclusion can be made on them.

Table 5. Results of Initial Mass Balance Assessment

River Reach	Incremental Load (mg/day)	
	All Data	Outliers Excluded
Coeur d'Alene to Post Falls	10	-
Post Falls to Barker Road	-	1.3
Barker Road to Trent Avenue	240	170
Trent Avenue to Spokane Gage	52	-
Spokane Gage to Nine Mile	-	-

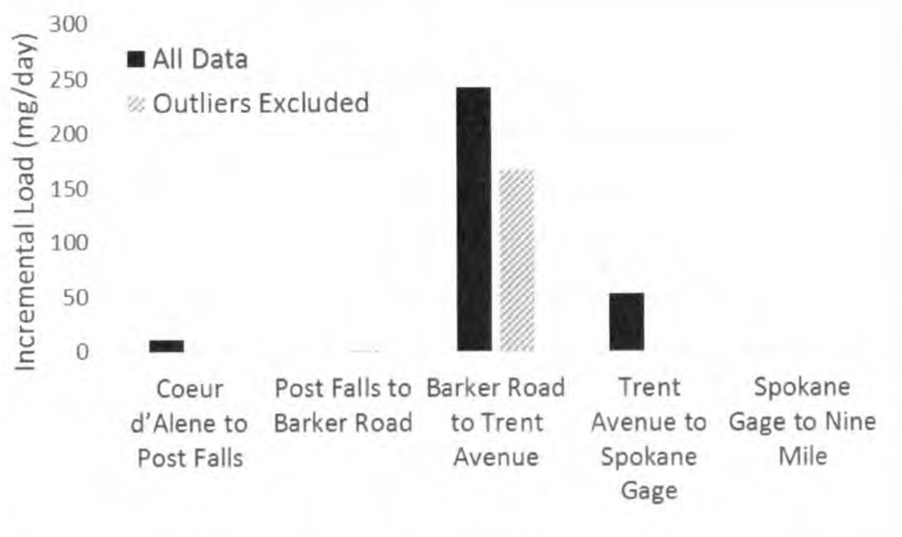

Figure 7. Results of Initial Mass Balance Assessment

3.3 Uncertainty Assessment

The results of the mass balance assessment have the potential to be highly uncertain, due to ambient PCB concentrations being very close to the level of blank contamination, as well as due to the day to day variability in observed concentrations and flows. In recognition of this fact, an assessment was conducted to attempt to quantify the uncertainty in the mass balance assessment.

The uncertainty assessment was conducted via Monte Carlo analysis, where each input to the mass balance assessment was characterized as a statistical frequency distribution instead of a single value. Statistical distributions for river flow wer based upon the observed day-to-day variability in flows observed over the survey period, and are displayed in Table 6 for river flows and Table 7 for discharge flows. In addition to a mean and standard deviation, a serial correlation coefficient was also specified to account for the fact that daily variation in river flows was correlated between gages, e.g. a higher than average flow on a given day at one gage was typically associated with higher than average flows that day at the other gages.

Table 6. Characterization of Uncertainty in River Flows Used in 2014 Mass Balance Assessment

	Mean (cfs)	Std. Dev. (cfs)	Distribution	Serial Correlation
Lake Coeur d'Alene*	735.6	109.8	Normal	0.92
Post Falls	741.3	109.8	Normal	1.0
Barker Rd.	399	124.4	Normal	0.92
Trent Ave.	973.7	60.4	Normal	0.94
Spokane	1118.6	73.8	Normal	0.84
Hangman Ck.	14.4	3.8	Normal	0.92
Nine Mile	1101.3	80.3	Normal	0.91

Table 7. Characterization of Uncertainty in Discharge Flows Used in 2014 Mass Balance Assessment

	Mean (cfs)	Std. Dev. (cfs)	Distribution
Coeur d'Alene	5.35	0.03	Normal
HARSB	0	0	Normal
Post Falls	3.89	0.12	Normal
Liberty Lake	1.12	0.04	Normal
Kaiser Aluminum	13.8	0.56	Normal
Inland Empire Paper	11.1	0.22	Normal
Spokane County	11.7	0.10	Normal
City of Spokane	44.1	1.44	Normal

The uncertainty in measured PCB concentrations was characterized by the summation of two components: 1) The observed day-to-day variability in measured concentration, and 2) The uncertainty caused by measurements at levels close to that of blank contamination. The input distributions used to represent these components are displayed in Table 8 for river concentrations and Table 9 for discharge concentrations.

Table 8. Characterization of Uncertainty in River Concentrations Used in 2014 Mass Balance Assessment

	Variability			Measurement Uncertainty		
	Mean (pg/l)	Std. Dev. (pg/l)	Distribution	Mean (pg/l)	Std. Dev. (pg/l)	Distribution
Lake Coeur d'Alene	12.59	9.14	Normal	0	15.4	Normal
Post Falls	16.04	5.04	Normal	0	15.4	Normal
Barker Rd.	18.73	14.7	Normal	0	15.4	Normal
Trent Ave.	140	29.4	Normal	0	15.4	Normal
Spokane	152.8	38.1	Normal	0	15.4	Normal
Hangman Ck.	59.76	13.7	Normal	0	15.4	Normal
Nine Mile	163.2	49.6	Normal	0	15.4	Normal

Table 9. Characterization of Uncertainty in Discharge Concentrations Used in 2014 Mass Balance Assessment

	Variability			Measurement Uncertainty		
	Mean (pg/l)	Std. Dev. (pg/l)	Distribution	Mean (pg/l)	Std. Dev. (pg/l)	Distribution
Coeur d'Alene	533	3	Lognormal	0	15.4	Normal
Post Falls	214	12	Lognormal	0	15.4	Normal
Liberty Lake	218	36	Lognormal	0	15.4	Normal
Kaiser Aluminum	3949	673	Lognormal	0	15.4	Normal
Inland Empire Paper	2978	456	Lognormal	0	15.4	Normal
Spokane County	361	82	Lognormal	0	15.4	Normal
City of Spokane	972	209	Lognormal	0	15.4	Normal

A Monte Carlo analysis was conducted for the mass balance assessment, whereby the mass balance calculations were repeated thousands of times, with the inputs for each simulation randomly selected from the statistical frequency distributions defined in Tables 6 through 9. The results of each simulation were stored, and then compiled to characterize the uncertainty in predicted unknown loads. The resulting frequency distributions are shown in Figures 8 through 12. Although the resulting uncertainty in estimated loads is relatively high, essentially the entire range of estimated loads for the Barker Rd. to Trent Ave. section are greater than zero, indicating high confidence that an unmonitored PCB load is entering the river in this segment.

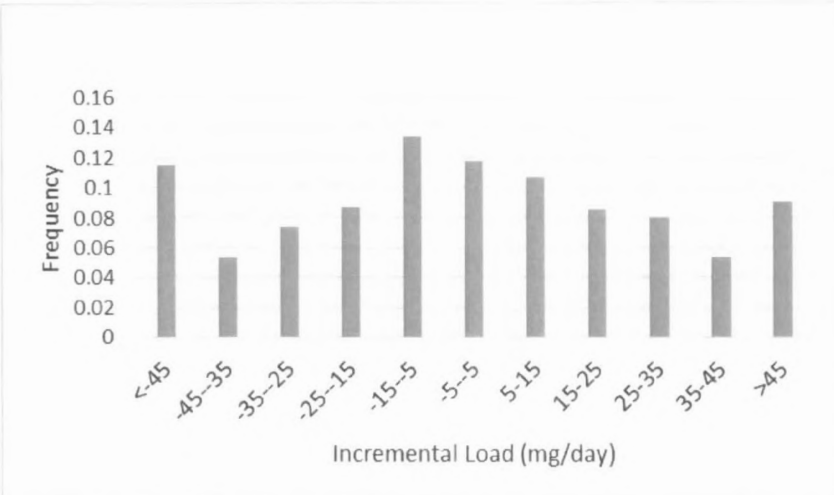

Figure 8. Uncertainty Distribution for Unknown Load - Lake Coeur d'Alene to Post Falls

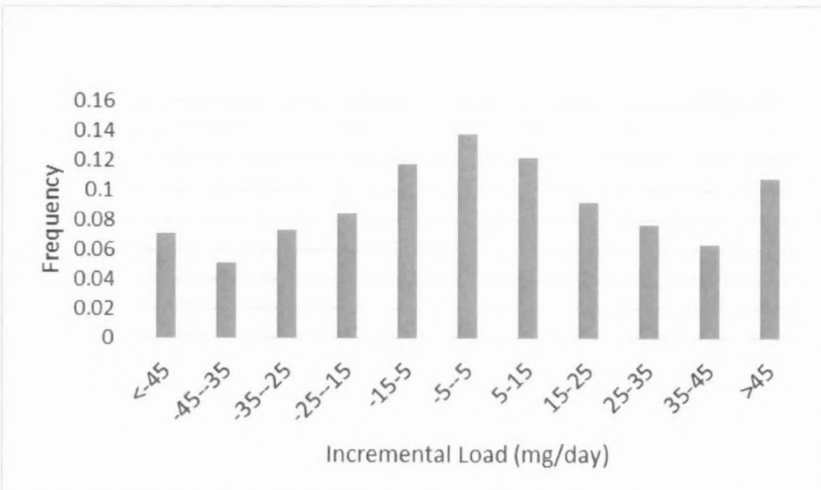

Figure 9. Uncertainty Distribution for Unknown Load - Post Falls to Barker Rd.

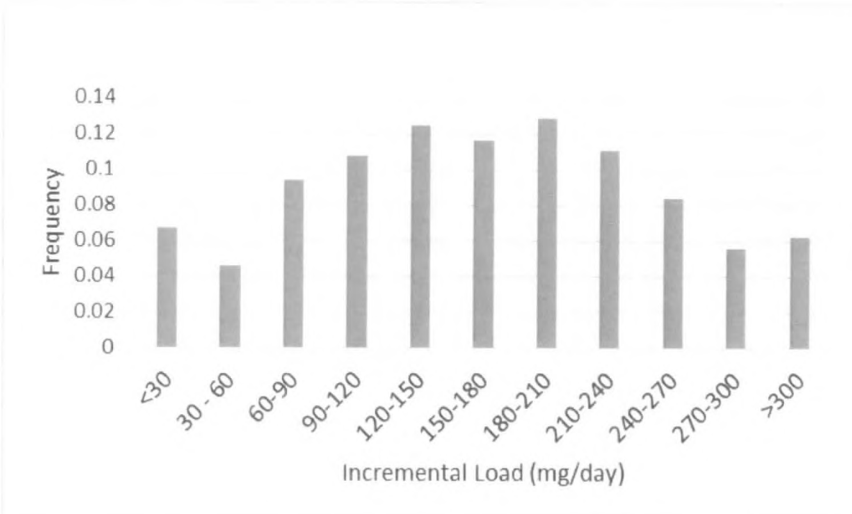

Figure 10. Uncertainty Distribution for Unknown Load - Barker Rd. to Trent Ave.

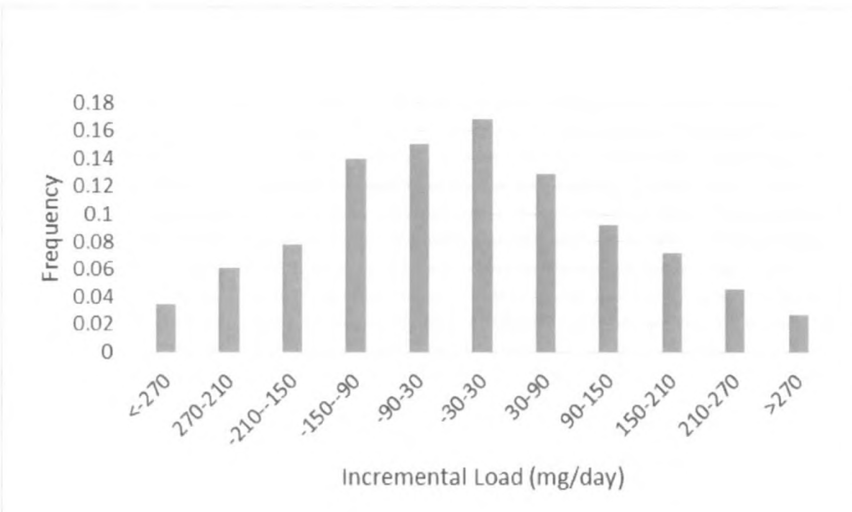

Figure 11. Uncertainty Distribution for Unknown Load - Trent Ave. to Spokane Gage

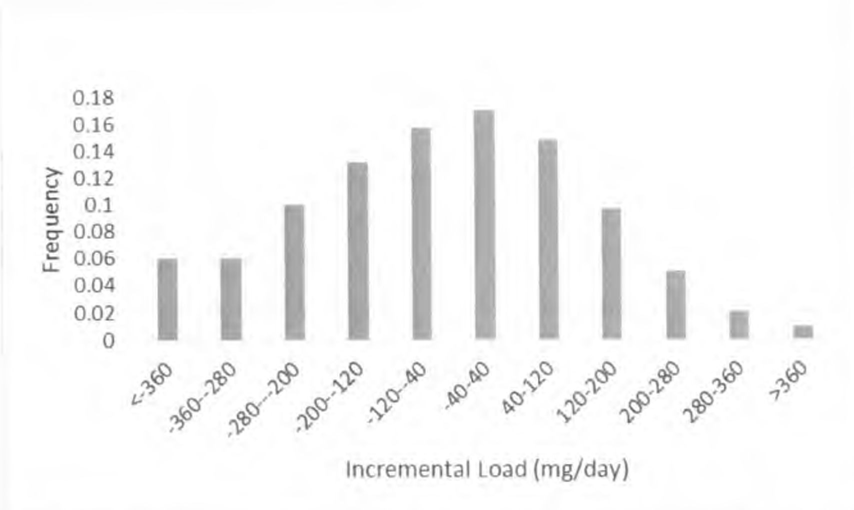

Figure 12. Uncertainty Distribution for Unknown Load - Spokane Gage to Nine Mile

3.4 Revisions to Initial Application

The results shown in Sections 3.2 and 3.3 were presented at the Spokane River Toxics Workshop held in Spokane Valley on January 13th and 14th, 2015. Comments received at the workshop led to the following revisions being conducted to the mass balance assessment:

- Sensitivity analysis of groundwater quality assumption
- Evaluation of stormwater and CSO loading
- Evaluation of flows below Nine Mile Dam
- Add Greene St. segment

Revisions to the analysis made in response to each of these comments is discussed below.

3.4.1 Sensitivity analysis of groundwater quality assumption

The original mass balance assessment was based upon the assumption that groundwater lost from an upstream reach re-entered in the next downstream gaining reach at the same concentration at which it left the river. A comment was raised at the workshop that this assumption was not necessarily valid. To address this concern, a sensitivity analysis was conducted assuming that any groundwater leaving the river did not return in the study area, and that any groundwater addition to the river represented "new" groundwater. Although exact groundwater pathways are not defined, the results of these two simulations (i.e. the original analysis and the sensitivity analysis described above) will cover the full range of possible outcomes. Similar to the sensitivity analysis on outliers, model results can be considered robust if the same conclusion is reached for the two alternate assumptions.

Results of the sensitivity analysis showed that the estimated unknown load in the Barker to Trent segment would change by less than ten percent if the groundwater assumption was changed from "groundwater lost from an upstream reach re-enters in the next downstream gaining reach" to "groundwater lost from an upstream reach does not re-enter in the study area." Because the sensitivity of results to this assumption was so small, it was concluded that uncertainty in

groundwater pathways did not detract from the primary finding that a significant source exists in the Barker to Trent segment.

3.4.2 Evaluation of stormwater and CSO loading

Although insufficient rainfall occurred at Felts Field in Spokane to violate the assumption of dry weather conditions as defined in the QAPP, it was noted at the January, 2014 workshop that some stormwater and CSO loading occurred during the synoptic survey in response to localized rainfall.

LimnoTech determined the significance of this stormwater and CSO loading on the mass balance assessment by repeating the assessment using best estimates of stormwater and CSO loads. Loading information was provided by the City of Spokane, which maintains flow meters on all CSO outfalls and three MS4 basins. CSO loads were calculated from monitored flows and average PCB concentration observed from 2012-2014. Flows from the MS4 system were estimated based on the flow meter at the Cochran Basin, scaled to represent overall drainage area. Stormwater PCB concentrations were set at the average of values observed in 2012-2014. The resulting loads are shown by river segment in Table 10.

Table 10. Summary of Estimated CSO and Stormwater PCB Flows (MGD) Loads (mg/day) during Synoptic Survey

	8/12		8/13		8/20		8/22	
	Flow	Load	Flow	Load	Flow	Load	Flow	Load
CSO								
Greene St. to Spokane Gage	0.90	42.	-	-	0.39	18.	4.0	190.
Spokane Gage to Nine Mile	0.43	20.	-	-	0.039	1.8	0.29	13.
Hangman Creek	-	-	-	-	-	-	0.052	2.4
MS4								
Trent Ave. to Greene St.	-	-	0.041	1.1	0.044	1.2	0.068	1.9
Greene St. to Spokane Gage		-	0.25	7.0	0.27	7.4	0.42	12.
Spokane Gage to Nine Mile	-	-	0.96	26.	1.0	28.	1.6	43.
Hangman Creek	-	-	0.063	1 .7	0.067	1.8	0.10	2.9

The original mass balance assessment was revisited to reflect the loads shown in Table 10. Results changed minimally, indicating that the stormwater and CSO loading did not bias the original mass balance conclusions.

3.4.3 Evaluation of flows below Nine Mile Dam

Questions were raised at the workshop regarding the basis of the flows reported by Gravity for the Nine Mile Dam station. The reported flows were the sum of Spokane Gage and Hangman Creek Gages, which would not reflect potential short-term changes in flow caused by operations at Nine Mile Dam. Conversations with staff in the field during the synoptic survey indicated that water levels were observed to be fluctuating at the Nine Mile Dam station. Avista confirmed that work was being done on Nine Mile Dam between August 14th and 18th and thus water levels were fluctuating during that time. Avista calculates flows at Nine Mile Dam for operational purposes, but these estimates are not intended to represent precise stream flows. While these estimates may be

imprecise, they do indicate that daily average flows varied from 520 to 1350 cfs over the course of the synoptic survey period. Given the observed fluctuations in water levels and flows at the Nine Mile Dam station, we conclude that the assumption of steady conditions inherent to the mass balance approach is sufficiently violated such that mass balance calculations for the Spokane Gage to Nine Mile Dam segment should be given little credence.

3.4.4 Add Greene St. Segment

River flow measurements were not available at the Greene St. gaging station for the period of the synoptic survey, so the original mass balance assessment combined the originally intended "Trent to Greene" and "Greene to Spokane Gage" segments into a single "Trent to Spokane Gage" segment. The Spokane River Flow Monitoring Workgroup synthesized flow estimates for Greene Street, such that the combined segment could be divided back into its original component pieces. Their work (Lindsay, 2015) found a strong correlation between observed Greene St. flows and Spokane Gage flows from the period August 18 and September 13, 1999. Furthermore, for periods of flow approximating those observed during the 2014 synoptic survey, flows at Greene St. were consistently around 255 cfs higher than those observed at the Spokane Gage on the same date. The mass balance assessment with outliers excluded was subsequently re-conducted to include the separate "Trent to Greene" and "Greene to Spokane Gage" segments by assuming Greene St. flows were 255 cfs higher than Spokane Gage. Results of the analysis are shown in Figure 13.

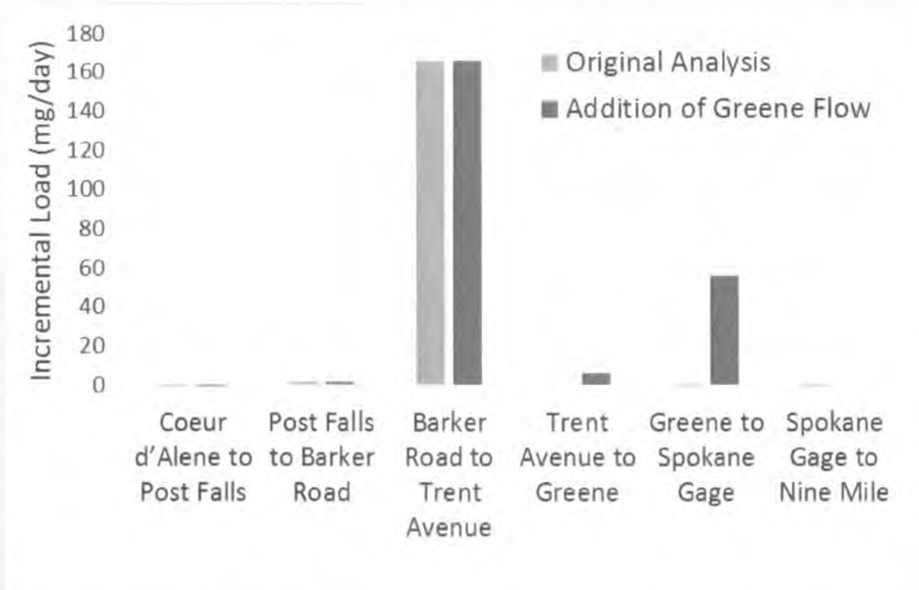

Figure 13. Revised Mass Balance Analysis Using Synthesized Greene St. Flows

The results are somewhat counter-intuitive, in that the original analysis of a single "Trent to Spokane Gage" segment with outliers omitted showed no incremental load, while dividing that segment into two pieces results in the determination of an incremental load - with a potentially large load between Greene St. and the Spokane gage. This outcome is due to the combination of a relatively simple mass balance model and a river system with complex groundwater/surface water interactions. These interactions are shown in Figure 14, which indicates that the river alternates

between reaches where water is lost from the river to the aquifer (i.e. losing reaches) and reaches where water is delivered to the river from the aquifer (i.e. gaining reaches.) The lumped segment between Trent Ave. and the Spokane gage contains a combination of gaining and losing reaches. During the synoptic survey, the net effect of groundwater exchange was an increase of flow to the river, as river flows at the Spokane gage were higher than the flows at Tent Avenue, even after accounting for the point sources that enter the river in that segment. When the lumped "Trent to Spokane Gage" segment is divided into two pieces, however, it contains a net gaining segment between Trent Ave. and Greene St., and a net losing segment between Greene St. and the Spokane gage. The increase in observed river PCB concentrations between Greene St. and the Spokane gage, in conjunction with a net loss of river flow, leads to the calculation of a large incremental load in this section of the river.

The results for this segment, in contrast to those found above for the Barker Rd. to Trent segment in Section 3.4.1, are seen to be very sensitive to the assumptions made regarding groundwater flow. In addition, conclusions regarding the incremental load to this segment are also dependent upon assumptions made regarding outlier data as shown in Section 3.2. For this reason, no clear determination can be made with the available data regarding the presence of an incremental load.

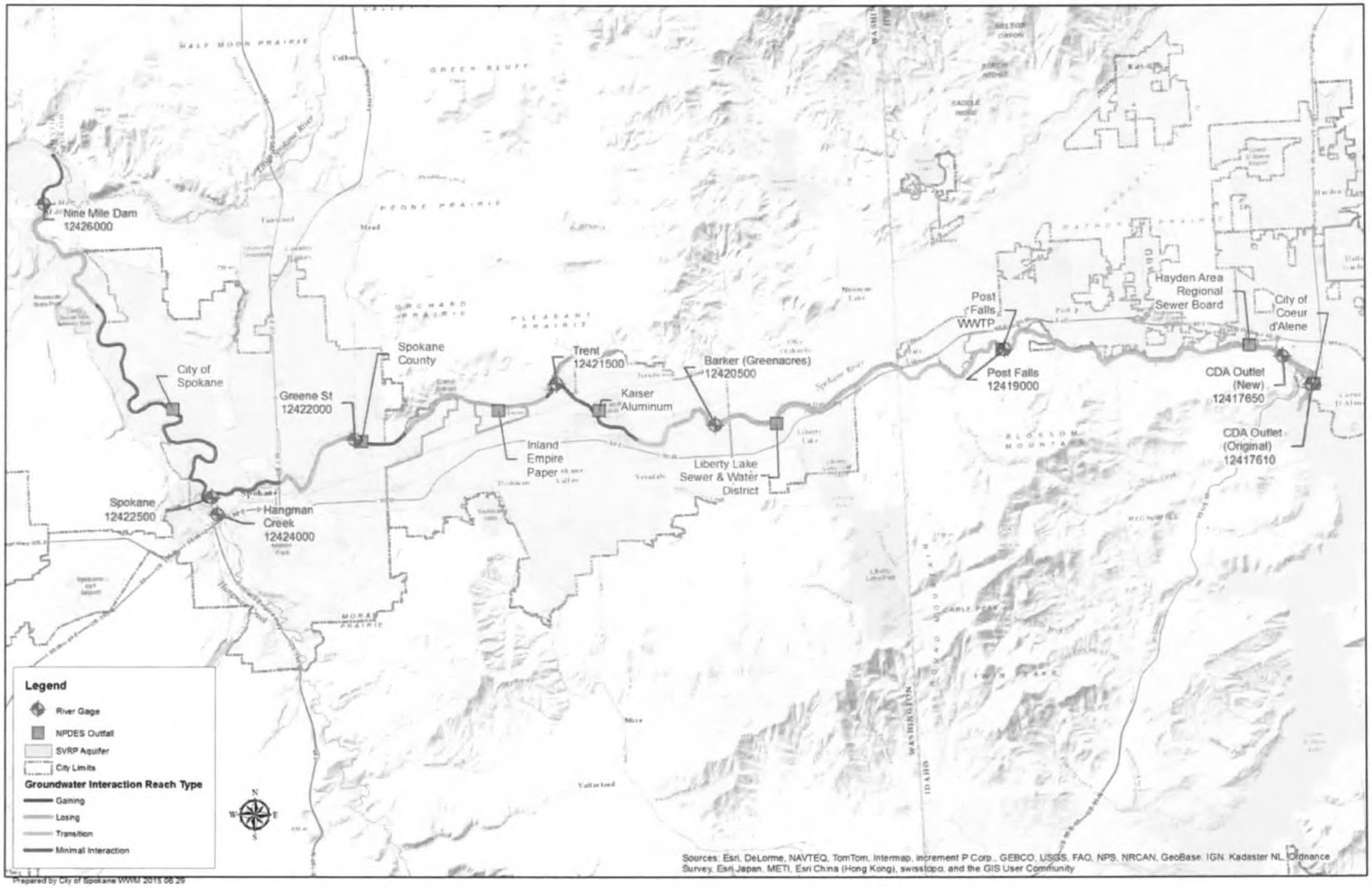

Figure 14. Map of Groundwater Interactions throughout Study Area

3.5 Summary of Mass Balance Assessment

The results of the semi-quantitative mass balance assessment are shown in Figure 15, with error bars representing the inter-quartile range (i.e. 25th to 75th percentile) determined from the uncertainty analysis. Specific units are left off the graph to emphasize that the objective of this study was to conduct a semi-quantitative analysis. No uncertainty estimate is available for the stormwater and CSO load.

The unknown load between Barker Road and the Trent Avenue Bridge is seen to be the largest load, and remains among the largest even at the low end of its uncertainty estimate. The next largest loads, in decreasing order, are the point source discharges from Kaiser Aluminum, the City of Spokane, and Inland Empire Paper. All remaining sources are relatively small, contributing 5% or less to the overall load. The uncertainty in the load between the Trent Avenue Bridge and Greene Street is noteworthy; although the best estimate for this load is relatively small, there is sufficient uncertainty around this estimate such that it cannot be ruled out as a significant contributor.

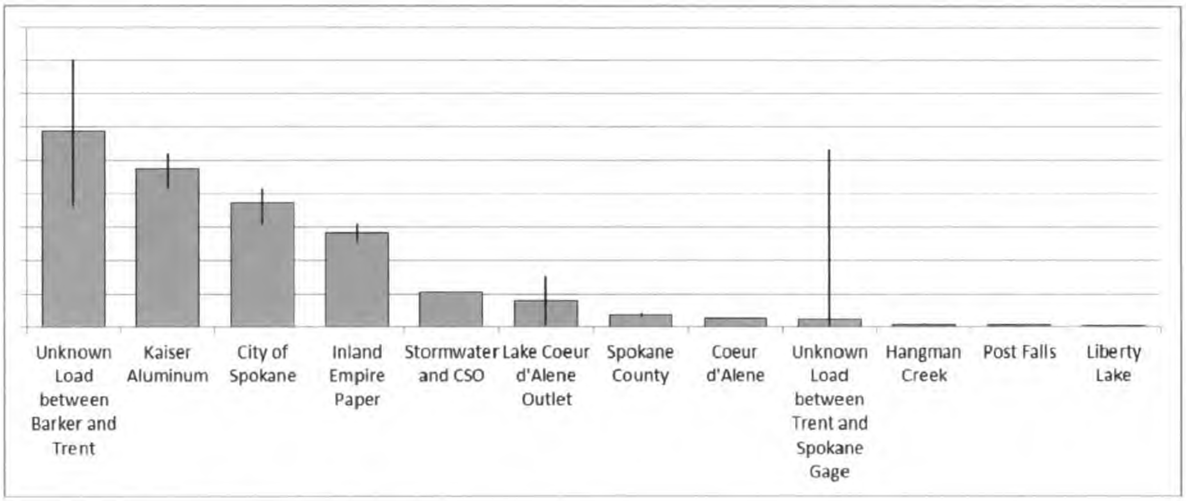

Figure 15. Summary of Mass Balance Estimates

Caution should be taken when comparing the results of this mass balance assessment to those of the PCB source assessment provided in Serdar et al (2011). While both assessments characterize PCB sources to the Spokane River, there are key differences between the studies. The primary differences relate to the temporal scale of the respective analyses, as this study focuses on summer dry weather, low flow, conditions while Serdar et al (2011) examine an entire year. PCB loads that are dependent upon climate (e.g. stormwater load) and river flow (e.g. Lake Coeur d'Alene outlet) will be substantially different between dry weather low flow and annual average conditions.

The following conclusions and "lessons learned" can be gathered from the mass balance analysis:

- The low concentrations of PCBs in the Spokane River (i.e. at magnitudes sometimes similar to those observed in blank samples) make precise calculations impossible and instead can best support semi-quantitative decisions.

- While the intent of this study was to collect sufficient data to conduct a mass balance assessment on six individual segments of the Spokane River, this intent was not fully realized due to:
  - The absence of planned stream flow gaging data at the Lake Coeur d'Alene outlet and at Greene St.
  - Dam operations at Nine Mile Dam caused large fluctuations in river flow that violated the assumption of steady state conditions.
- There is very likely a large (i.e. as large as any other single dry weather source) incremental PCB load entering the Spokane River between Barker Road and the Trent Avenue Bridge. There is the possibility of a large incremental PCB load entering the Spokane River between Greene Street and the Spokane gage. While Phase 2 activities are ongoing, Phase 3 activities are now underway to characterize the specific nature of these sources.

Blank Page

4
SEASONALLY INTEGRATED SAMPLING

Seasonally Integrated Sampling was intended to provide information on the seasonal variability of upstream PCB loading to the Spokane River from Lake Coeur d'Alene, which will provide insight on the atmospheric contribution to the snow pack in the upstream watershed.

The sampling was originally intended to be conducted on a seasonally integrated basis, with multiple samples taken and composited over each of three different flow regimes:

- Spring high flow
- Summer low flow
- Winter moderate flows

Spring high flow monitoring was conducted May 13-21, 2014 at the Spokane River near Lake Coeur d'Alene outlet station shown previously in Figure 1, and is documented in LimnoTech (2014b) and included as an appendix to this report. Concentrations at the Lake Coeur d'Alene outlet are shown in Table 11, with total PCB concentrations in river samples not being appreciably higher than concentrations observed in laboratory blanks. The summer low flow portion of the Seasonally Integrated Sampling was satisfied as part of the 2014 synoptic survey, with all results provided in Appendix A. Given the relatively small snow pack that occurred in the winter of 2014-2015, and the lack of observable concentrations during the spring high flow portion of the Seasonally Integrated Sampling, it was concluded at the January 2014 workshop to indefinitely forego sampling for the winter moderate flow condition.

Table 11. PCB Concentrations at Lake Coeur d'Alene Outlet during Spring High Flow Sampling

Date	Total PCB (pg/L)
5/13	7.8
5/13	13.
5/15	15.
5/15	22.
5/17	32.
5/17	48.

5 REFERENCES

Era-Miller, B. 2014. Spokane River Toxics Sampling 2012-2013 – Surface Water, CLAM and Sediment Trap Results. Washington Department of Ecology, Environmental Assessment Program. May 30, 2014.

Gravity Consulting, L.L.C., 2015. 2014 Spokane River Field Sampling Report. Spokane River Regional Toxics Task Force. Washington and Idaho. Prepared for SRRTTF. January, 2015.

LimnoTech. 2013a. Data Request Memorandum in Support of PCB and Dioxin Control. April 17, 2013. Prepared for the Spokane River Regional Toxics Task Force. April 17, 2013.

LimnoTech. 2013b. Review of Standard Operating Procedures for PCB Data Collection and Analysis. Prepared for the Spokane River Regional Toxics Task Force. June, 28, 2013.

LimnoTech. 2013c. Data Acquisition Contact Log. Prepared for the Spokane River Regional Toxics Task Force. June, 28, 2013.

LimnoTech. 2013d. Review and Evaluation of Existing Data - Final. Prepared for the Spokane River Regional Toxics Task Force. August 30, 2013.

LimnoTech. 2013e. Identification of Data Gaps - Final. Prepared for the Spokane River Regional Toxics Task Force. November 14, 2013.

LimnoTech. 2014a. Data Collection Strategy for PCB Comprehensive Plan. Prepared for the Spokane River Regional Toxics Task Force. February 4, 2014.

LimnoTech. 2014b. Confidence Testing Results from Spokane River PCB Sampling. Prepared for the Spokane River Regional Toxics Task Force. July 16, 2014.

LimnoTech. 2014c. Quality Assurance Project Plan. Spokane River Toxics Reduction Strategy Study. Prepared for the Spokane River Regional Toxics Task Force. July 23, 2014.

LimnoTech. 2014d. Sampling and Analysis Plan. Spokane River Toxics Reduction Strategy Study. Prepared for the Spokane River Regional Toxics Task Force. July 31, 2014.

Lindsay, Rob. 2015. Correlation between Greene Street Bridge flow and Spokane Gage flow measurements. E-mail and spreadsheet sent March 5, 2015.

Serdar, D., B. Lubliner, A. Johnson, and D. Norton. 2011. Spokane River PCB Source Assessment, 2003-2007. Washington Department of Ecology, Toxics Studies Unit, Environmental Assessment Program. Department of Ecology Publication No. 11-03-013.

Spokane Tribe of Indians, 2010. Surface Water Quality Standards, Resolution 2010-173. February 25, 2010.

SRRTTF, 2012. Spokane River Regional Toxics Task Force (SRRTTF) First Draft Work Plan. Adopted 10-24-2012. http://srrttf.org/wp-content/uploads/2012/10/SRRTTF-Work-Plan-First-Draft-Adopted-10-24-12-CLEAN1.pdf

Virginia DEQ, 2014. TMDL Guidance Memo No. 14-2004. Procedures for reviewing and deriving total PCB concentrations from samples analyzed using low-level PCB method 1668 to be used in the development and implementation of TMDLs.

http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/PCB/Guidance%2014-2004/GM14-2004_Final_PCB_Calculation_Guidance.pdf

Appendix A:
Synoptic Survey Results

Blank Page

Table A-1: Analytical Results for Hangman Creek

Station HC1	8 / 12	8 / 14	8 / 16	8 / 16-R	8 / 18	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	76.2	104	101	110	77.3	2450	297	103
Total Monochloro Biphenyls (pg/l)	5.2	1.26	1.01	0.814	0.895	2.09	1.52	0.892
Total Dichloro Biphenyls (pg/l)	8.59	11.5	13.1	11.4	8.81	50.7	13.6	8.5
Total Trichloro Biphenyls (pg/l)	8.4	13.5	8.74	11.9	9.64	341	18.1	12.8
Total Tetrachloro Biphenyls (pg/l)	15.2	19.3	17.4	19.4	16.8	672	39.3	18
Total Pentachloro Biphenyls (pg/l)	21.8	26.8	28.8	29.1	22.1	704	93.6	29.7
Total Hexachloro Biphenyls (pg/l)	11.5	21.4	24.1	26.8	15.9	443	80.3	22.6
Total Heptachloro Biphenyls (pg/l)	4.38	7.47	7.84	8.91	2.57	183	33	7.42
Total Octachloro Biphenyls (pg/l)	0.873	2.43	0.3	UJ	0.556	44.7	12	1.64
Total Nonachloro Biphenyls (pg/l)	0.307	UJ	UJ	0.618	UJ	8.26	3.54	1.19
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	0.784	UJ	5.05	2.18	UJ
Total Dissolved Solids (mg/l)	241	260	256	256	245	243	250	245
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	2.69	2.86	2.86	2.86	2.94	2.65	3.33	3.05
Dissolved Organic Carbon (mg/l)	2.74	2.86	2.59	2.59	2.8	2.48	2.97	2.59

Table A-2: Analytical Results for Spokane River below 9 Mile Dam

Station SR1	8 / 12	8/12-R	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	159	200	195	183	171	234	168	150
Total Monochloro Biphenyls (pg/l)	1.65	2.72	1.74	1.44	2.69	1.7	1.33	3.03
Total Dichloro Biphenyls (pg/l)	48.9	50.6	37.6	35.4	30.3	32.3	28.4	29.2
Total Trichloro Biphenyls (pg/l)	26.2	34.4	33.1	28.9	28.2	35.1	26.3	25.2
Total Tetrachloro Biphenyls (pg/l)	36.5	45.8	42.2	48.2	42.1	56.1	44.3	38.3
Total Pentachloro Biphenyls (pg/l)	25.9	39.2	43.4	34.1	36.5	56.5	38.8	32.7
Total Hexachloro Biphenyls (pg/l)	15.2	19.2	26	30.1	24.3	36	21.5	16.7
Total Heptachloro Biphenyls (pg/l)	4.4	5.53	6.97	3.29	5.59	13.4	6.66	3.74
Total Octachloro Biphenyls (pg/l)	0.411	1.3	3.9	1.51	1.18	2.76	1.14	1.03
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	0.572	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	0.805	0.474	UJ	UJ	0.65	UJ	UJ
Total Dissolved Solids (mg/l)	146	146	137	157	160	155	142	143
Total Suspended Solids (mg/l)	5	5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.31	1.31	1.64	1.32	1.29	1.32	1.39	1.18
Dissolved Organic Carbon (mg/l)	1.5	1.5	1.57	1.4	1.24	1.27	1.16	1.12

Table A-3: Analytical Results for Liberty Lake Sewer & Water District

Station SR10	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	203	195	267
Total Monochloro Biphenyls (pg/l)	15.5	13.6	21.3
Total Dichloro Biphenyls (pg/l)	58	58.5	67
Total Trichloro Biphenyls (pg/l)	40.5	40.3	52.6
Total Tetrachloro Biphenyls (pg/l)	45.9	42.6	59
Total Pentachloro Biphenyls (pg/l)	31.2	30.1	46.9
Total Hexachloro Biphenyls (pg/l)	8.23	8.4	14.9
Total Heptachloro Biphenyls (pg/l)	2.48	1.07	4.37
Total Octachloro Biphenyls (pg/l)	0.326	0.363	0.272
Total Nonachloro Biphenyls (pg/l)	0.446	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	0.49
Total Dissolved Solids (mg/l)	277	288	294
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	6.43	6.64	6.36
Dissolved Organic Carbon (mg/l)	6.6	6.16	6.16

Table A-4: Analytical Results for Post Falls WWTP

Station SR11	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	226	219	213
Total Monochloro Biphenyls (pg/l)	15.4	16.4	18.3
Total Dichloro Biphenyls (pg/l)	30	31.9	18.4
Total Trichloro Biphenyls (pg/l)	40.6	41.9	29.9
Total Tetrachloro Biphenyls (pg/l)	62.1	52.5	64.5
Total Pentachloro Biphenyls (pg/l)	45.7	43.7	47.1
Total Hexachloro Biphenyls (pg/l)	23.6	25.5	24.4
Total Heptachloro Biphenyls (pg/l)	8.59	7.07	9.44
Total Octachloro Biphenyls (pg/l)	UJ	0.319	0.577
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	353	349	361
Total Suspended Solids (mg/l)	5	<5.0	<5.0
Total Organic Carbon (mg/l)	7.98	7.8	7.04
Dissolved Organic Carbon (mg/l)	7.66	6.79	6.69

Table A-5: Analytical Results for Spokane River at Post Falls								
Station SR12	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8 / 24	8/24-R
Total PCBs (pg/l)	65.9	51.4	44.4	61.2	40.8	50.1	71.3	40.8
Total Monochloro Biphenyls (pg/l)	3.24	1.18	1.66	1.24	1.29	0.515	0.674	1.69
Total Dichloro Biphenyls (pg/l)	9.45	8.19	3.87	7.48	7.39	5.08	5.78	5.3
Total Trichloro Biphenyls (pg/l)	9.51	6.02	6.31	10.1	8.48	3.74	9.54	5.21
Total Tetrachloro Biphenyls (pg/l)	14.4	14.3	8.34	13.3	9.38	7.39	16.3	7.09
Total Pentachloro Biphenyls (pg/l)	18.6	11.3	10.5	15.3	8.63	6.03	21.6	11.1
Total Hexachloro Biphenyls (pg/l)	5.29	8.93	10	11.7	2.91	18	14.6	7.17
Total Heptachloro Biphenyls (pg/l)	3.57	1.17	1.63	1.66	2.44	8.46	1.62	2.34
Total Octachloro Biphenyls (pg/l)	0.561	UJ	1.84	0.334	UJ	0.844	0.771	0.4
Total Nonachloro Biphenyls (pg/l)	1.33	0.344	0.269	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	0.331	UJ	0.505	0.46
Total Dissolved Solids (mg/l)	39	36	33	31	35	37	32	32
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.69	1.76	1.6	1.61	1.54	1.72	1.55	1.55
Dissolved Organic Carbon (mg/l)	1.72	1.69	1.52	1.68	1.5	1.45	1.38	1.38

Table A-6: Analytical Results for Coeur d'Alene Advanced WWTP			
Station SR14	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	1240	534	535
Total Monochloro Biphenyls (pg/l)	7.66	9.03	10.6
Total Dichloro Biphenyls (pg/l)	135	102	103
Total Trichloro Biphenyls (pg/l)	127	85.4	87.2
Total Tetrachloro Biphenyls (pg/l)	277	106	118
Total Pentachloro Biphenyls (pg/l)	341	122	119
Total Hexachloro Biphenyls (pg/l)	244	71.9	65.9
Total Heptachloro Biphenyls (pg/l)	81.5	28.4	24.5
Total Octachloro Biphenyls (pg/l)	17	7.12	6.06
Total Nonachloro Biphenyls (pg/l)	3.59	1.28	UJ
Total Decachloro Biphenyls (pg/l)	2	UJ	UJ
Total Dissolved Solids (mg/l)	392	410	433
Total Suspended Solids (mg/l)	16	5	<5.0
Total Organic Carbon (mg/l)	13.4	8.49	7.46
Dissolved Organic Carbon (mg/l)	11.7	7.25	6.92

Table A-7: Analytical Results for Lake Coeur d'Alene Outlet

Station SR15	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8 / 23
Total PCBs (pg/l)	30.6	40.6	32.5	36.9	27.4	37.1	33.3
Total Monochloro Biphenyls (pg/l)	1.75	1.11	1.03	0.423	0.374	1.67	0.883
Total Dichloro Biphenyls (pg/l)	4.71	5.16	3.47	6.2	5.91	4.64	4.33
Total Trichloro Biphenyls (pg/l)	3.51	2.65	3.59	6.33	3.81	5.48	5.72
Total Tetrachloro Biphenyls (pg/l)	7.44	7.94	7.84	7.84	8.32	6.87	8.99
Total Pentachloro Biphenyls (pg/l)	8.67	11.3	8.21	10	6.65	9.35	6.94
Total Hexachloro Biphenyls (pg/l)	3.81	11.1	6.3	3.59	1.42	7.78	4.67
Total Heptachloro Biphenyls (pg/l)	0.422	0.847	1.81	1.63	0.56	1.31	1.54
Total Octachloro Biphenyls (pg/l)	0.294	UJ	0.278	0.343	0.348	UJ	0.241
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	0.414	UJ	0.517	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	23	33	31	29	32	34	29
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.46	1.61	1.41	1.38	1.58	1.42	1.48
Dissolved Organic Carbon (mg/l)	1.62	1.61	1.5	1.47	1.4	1.39	1.28

Table A-8: Analytical Results for City of Spokane Riverside Park Advanced WWTP

Station SR2	8 / 13	8/13-R	8 / 19	8 / 21
Total PCBs (pg/l)	771	965	23400	1190
Total Monochloro Biphenyls (pg/l)	5.09	7.84	3.77	9.1
Total Dichloro Biphenyls (pg/l)	78.1	80.1	141	102
Total Trichloro Biphenyls (pg/l)	126	122	887	169
Total Tetrachloro Biphenyls (pg/l)	172	221	3390	248
Total Pentachloro Biphenyls (pg/l)	229	296	6250	349
Total Hexachloro Biphenyls (pg/l)	122	170	6340	217
Total Heptachloro Biphenyls (pg/l)	32	44.7	4530	77.3
Total Octachloro Biphenyls (pg/l)	2.76	16.7	1690	19.5
Total Nonachloro Biphenyls (pg/l)	2.03	3.97	150	3.1
Total Decachloro Biphenyls (pg/l)	0.86	1.64	15.6	1.19
Total Dissolved Solids (mg/l)	418	418	446	414
Total Suspended Solids (mg/l)	11	11	10	9
Total Organic Carbon (mg/l)	9.1	9.1	8.02	7.54
Dissolved Organic Carbon (mg/l)	8.72	8.72	6.63	6.98

Table A-9: Analytical Results for at Spokane Gage								
Station SR3	8 / 12	8 / 14	8/14-R	8 / 16	8 / 18	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	164	184	144	308	205	172	409	165
Total Monochloro Biphenyls (pg/l)	2.61	1.83	2.38	1.58	1.55	0.914	3.15	1.92
Total Dichloro Biphenyls (pg/l)	27.8	28.5	20.7	35.4	29.1	12.7	24.6	20.7
Total Trichloro Biphenyls (pg/l)	34.3	43.8	31.2	48.9	41	29.1	50.2	32.7
Total Tetrachloro Biphenyls (pg/l)	42	50.6	38.8	73.4	52.3	57.1	85.8	45.6
Total Pentachloro Biphenyls (pg/l)	35.1	33.9	32	81.2	44.8	42.3	121	38.2
Total Hexachloro Biphenyls (pg/l)	20	21.3	15	45.4	25	23.4	83.5	20.7
Total Heptachloro Biphenyls (pg/l)	1.97	4.03	3.68	14.6	9.05	5.68	28.6	4.11
Total Octachloro Biphenyls (pg/l)	0.53	UJ	0.654	4.35	0.78	0.568	8.55	1.02
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	1.88	0.315	UJ	2.12	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	1.13	0.72	UJ	0.717	UJ
Total Dissolved Solids (mg/l)	124	132	132	127	129	125	119	121
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.26	1.13	1.13	1.14	1.14	1.18	1.17	1.26
Dissolved Organic Carbon (mg/l)	1.29	1.05	1.05	1.07	1.21	1.05	1.16	1.05

Table A-10: Analytical Results for Spokane River at Greene Street Bridge								
Station SR4	8 / 13	8 / 14	8 / 16	8 / 18	8/18-R	8 / 20	8 / 22	8 / 24
Total PCBs (pg/l)	173	214	138	152	121	190	138	124
Total Monochloro Biphenyls (pg/l)	3.24	7.24	1.06	1.77	2.89	UJ	4.58	4.42
Total Dichloro Biphenyls (pg/l)	21.6	23.2	18.6	17.7	17.1	9.23	14.7	15.9
Total Trichloro Biphenyls (pg/l)	32.9	42.1	36.8	40.2	34.4	50.1	37.6	32.1
Total Tetrachloro Biphenyls (pg/l)	45	54.9	44.5	54	40.2	76.8	50.3	43.8
Total Pentachloro Biphenyls (pg/l)	31.7	28.7	18.7	24.1	16.4	29.5	19.3	15.7
Total Hexachloro Biphenyls (pg/l)	20.8	28.9	14.6	11.8	6.97	18.3	8.98	8.84
Total Heptachloro Biphenyls (pg/l)	11.4	21.6	2.3	2.27	2.44	5.32	1.67	2.53
Total Octachloro Biphenyls (pg/l)	5.24	5.49	0.943	0.389	0.221	1.21	UJ	0.302
Total Nonachloro Biphenyls (pg/l)	1.52	1.57	UJ	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	0.641	UJ	UJ	UJ	UJ	0.39	0.481
Total Dissolved Solids (mg/l)	126	133	138	153	153	129	124	125
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.48	1.2	1.5	1.14	1.14	1.06	<1	1.32
Dissolved Organic Carbon (mg/l)	1.5	1.09	1.26	1.12	1.12	<1	<1	1.04

Table A-11: Analytical Results for Spokane County Regional Water Reclamation Facility

Station SR5	8 / 13	8 / 19	8/19-R	8 / 21
Total PCBs (pg/l)	496	331	296	338
Total Monochloro Biphenyls (pg/l)	5.04	3.94	6.11	5.74
Total Dichloro Biphenyls (pg/l)	77.6	71.1	65.9	75.2
Total Trichloro Biphenyls (pg/l)	78.3	90.8	88.2	97.8
Total Tetrachloro Biphenyls (pg/l)	98.3	87	76.5	92.5
Total Pentachloro Biphenyls (pg/l)	98.3	58.9	47.9	54.1
Total Hexachloro Biphenyls (pg/l)	87	13.7	10.5	9.72
Total Heptachloro Biphenyls (pg/l)	40.8	3.42	0.962	2.74
Total Octachloro Biphenyls (pg/l)	8.58	1.02	UJ	UJ
Total Nonachloro Biphenyls (pg/l)	1.49	0.41	UJ	UJ
Total Decachloro Biphenyls (pg/l)	0.769	0.352	UJ	0.594
Total Dissolved Solids (mg/l)	602	524	524	500
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	5.96	4.99	4.99	4.28
Dissolved Organic Carbon (mg/l)	6.01	4.62	4.62	4.22

Table A-12: Analytical Results for Inland Empire Paper

Station SR6	8 / 13	8 / 19	8 / 21	8/21-R
Total PCBs (pg/l)	4190	2970	2640	2630
Total Monochloro Biphenyls (pg/l)	69.5	52.2	45	45.8
Total Dichloro Biphenyls (pg/l)	1010	692	588	590
Total Trichloro Biphenyls (pg/l)	1840	1390	1190	1210
Total Tetrachloro Biphenyls (pg/l)	1040	684	621	622
Total Pentachloro Biphenyls (pg/l)	176	130	138	121
Total Hexachloro Biphenyls (pg/l)	40.4	14.6	31.7	29.3
Total Heptachloro Biphenyls (pg/l)	8.18	4.41	12.7	11.2
Total Octachloro Biphenyls (pg/l)	4.43	2.17	4.66	1.95
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	1.03
Total Decachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	695	528	487	487
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	52.5	42.2	32.7	32.7
Dissolved Organic Carbon (mg/l)	50.9	37.7	29.7	29.7

Table A-13: Analytical Results for Spokane River Below Trent Bridge

Station SR7	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 20-R	8 / 22	8 / 24
Total PCBs (pg/l)	177	138	171	414	169	187	128	148
Total Monochloro Biphenyls (pg/l)	1.78	0.741	1.61	1.32	1.11	1.44	1.29	1.6
Total Dichloro Biphenyls (pg/l)	10	8.79	10.8	11.3	10.9	11.5	2.88	7.81
Total Trichloro Biphenyls (pg/l)	39.4	41.2	44.6	95.1	45.3	49.7	37.3	44.6
Total Tetrachloro Biphenyls (pg/l)	86.8	66.2	87.1	211	81	87.5	65.6	72.3
Total Pentachloro Biphenyls (pg/l)	29	15.9	20.4	79.3	23	25.6	16	17.4
Total Hexachloro Biphenyls (pg/l)	7.27	4.46	4.26	12.7	6.1	8.08	4.38	4.37
Total Heptachloro Biphenyls (pg/l)	2.43	0.548	2.43	1.93	0.735	1.85	0.799	0.198
Total Octachloro Biphenyls (pg/l)	0.833	UJ	UJ	0.62	0.521	1.06	UJ	UJ
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	UJ	UJ	UJ	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	0.385	UJ	UJ	0.398	UJ	UJ
Total Dissolved Solids (mg/l)	126	129	125	108	108	108	113	116
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	<1	<1	1.31	<1	<1	<1	<1	<1
Dissolved Organic Carbon (mg/l)	<1	<1	<1	<1	<1	<1	<1	<1

Table A-14: Analytical Results for Kaiser Aluminum

Station SR8	8 / 13	8 / 19	8 / 21
Total PCBs (pg/l)	3290	4020	4640
Total Monochloro Biphenyls (pg/l)	5.79	4.64	6.39
Total Dichloro Biphenyls (pg/l)	227	227	238
Total Trichloro Biphenyls (pg/l)	1370	1570	1860
Total Tetrachloro Biphenyls (pg/l)	1410	1810	2120
Total Pentachloro Biphenyls (pg/l)	234	319	372
Total Hexachloro Biphenyls (pg/l)	27.3	52.2	35.2
Total Heptachloro Biphenyls (pg/l)	7.99	21	7.13
Total Octachloro Biphenyls (pg/l)	0.499	9.61	1.12
Total Nonachloro Biphenyls (pg/l)	UJ	0.383	UJ
Total Decachloro Biphenyls (pg/l)	0.61	UJ	UJ
Total Dissolved Solids (mg/l)	179	184	179
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.7	1.98	1.51
Dissolved Organic Carbon (mg/l)	1.62	1.34	1.22

Table A-15: Analytical Results for Spokane River at Barker Road Bridge								
Station SR9	8 / 12	8 / 14	8 / 16	8 / 18	8 / 20	8 / 22	8/22-R	8 / 24
Total PCBs (pg/l)	43.3	56.7	35.4	80.6	42	26.9	73.2	37.1
Total Monochloro Biphenyls (pg/l)	1.72	2.79	1.24	9.8	1.66	1.78	1.07	1.26
Total Dichloro Biphenyls (pg/l)	7.35	9.14	5.64	15.4	9.24	5.36	5.31	6.65
Total Trichloro Biphenyls (pg/l)	3.9	7.84	5.31	22.7	7.28	4.99	5.15	7.75
Total Tetrachloro Biphenyls (pg/l)	9.85	13.5	8.24	15.2	10.1	5.89	11.6	8.9
Total Pentachloro Biphenyls (pg/l)	9.66	12.2	7.18	12.1	5.94	3.85	18.6	6.55
Total Hexachloro Biphenyls (pg/l)	8.27	6.7	5.45	3.16	5.14	4.39	19.6	4.04
Total Heptachloro Biphenyls (pg/l)	2.04	4.53	1.88	1.41	2.23	0.225	10.3	1.57
Total Octachloro Biphenyls (pg/l)	0.537	UJ	UJ	0.377	0.39	0.391	1.25	0.334
Total Nonachloro Biphenyls (pg/l)	UJ	UJ	UJ	UJ	UJ	UJ	0.353	UJ
Total Decachloro Biphenyls (pg/l)	UJ	UJ	0.402	0.511	UJ	UJ	UJ	UJ
Total Dissolved Solids (mg/l)	39	31	28	33	37	39	39	30
Total Suspended Solids (mg/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Organic Carbon (mg/l)	1.75	1.63	1.64	1.49	1.48	1.61	1.61	1.43
Dissolved Organic Carbon (mg/l)	1.74	1.61	1.54	1.8	1.51	1.43	1.43	1.42

Appendix B:
Gravity Report

Blank Page

Appendix C:
Quality Assurance Project Plan

Blank Page

Appendix D:
Sampling & Analysis Plan

Blank Page

Appendix E: Confidence Interval Testing Memorandum

Blank Page

Appendix F: Laboratory Results

Provided separately as electronic spreadsheets

Blank Page